Global Scientific JOURNALS

GSJ: Volume 13, Issue 9, September 2025, Online: ISSN 2320-9186
www.globalscientificjournal.com

# Tunnelling effect-experiments outcome observation

Dr. Bechor Zafrir, PhD,

September 2025,

**Abstract:**

A new model of quantum tunnelling was investigated by moving particles through metals barrier.
In this preliminary experiment, the probability of a particles from a constant magnetic field (B) to tunnelling through higher potential energies barrier then the particle kinetic energy has examined.
Although this study tested metals for potential particles barrier, the "free electron model of metals" (1) is out of the scope of present paper. In addition, this is a straightforward study of practical experimental physics without any mathematical methods and the obtained results analysed and present as insights.

A constant magnetic field induced by magnetic bar with N and S poles, as well as by attached three round magnets when electric field used. The magnetic field measured by Tesla meter model: GT129C. The effect of the magnet poles was investigated as well.

First Experiment: **Quantum Tunnelling**: The magnetic bar distance from the sensor was 27.7mm and 13mm from the metal barrier. The metals depth ("Width") ranges from 0.5 mm to 2mm. Different kind of metals used such as alloy, steel, aluminium, silver, copper, zinc. The results indicate that particles passed through the metals barrier at 50-80 precent, however, Zinc and Copper produce zero potential barrier. The magnetic poles showed different amplitude of the magnetic field.

The metal barriers showed an amplitude reduction of the magnetic field post potential barrier as predicted by quantum tunnelling theory (2)(3), which is usually present by mathematical way such as wave function by Schrodinger equation with the sinusoidal wave function becomes exponentially diminishing post energy barrier.
Second Experiment: **Field Emission**: magnetic field through an electric field tested with magnetic field sensor located inside the electric field. The constant magnetic field through electric field induced by stronger magnetic field than the magnetic bar by three attached round magnets at distance of 15mm, 35mm and 55mm from the barrier points, whereas the last two locations were in electric field. Source voltage was 2.7V.
When the metals measured in three separate locations each time, the results have shown different amplitudes. Surprise, the metal barrier at the most distal location from the magnet field source, showed larger amplitude, located in electric field (3) whereas the two other locations show equivalent B field's amplitude, obviously smaller than the source B field. That phenomenon can related to "Fowler-Nordheim Theory" (4).

This is in contrasts with the quantum theory that predict amplitude reduction and diminishing distally to a potential barrier.

Zinc and Copper show no amplitude changes with locations.

In general, S magnetic pole showed higher B amplitude whereas N pole showed the highest precent change at location point three. However, changing electric field direction by replacing between the positive and negative plates has no effect.

Some results indicate that when negative charged metal barrier close to the negative side of the electric field it has higher amplitude of the B field.

Nevertheless, negative polarity plate has shown similar trend between location with and without constant magnetic field source although with different amplitudes.

Third Experiment. **Finite Potential well**:

Two parallel metal positive charge steel plates connected to 2.2 DC volts. A magnetic bar measured for magnetic field (B) behind the distal plate and between the plates. When the S pole used there was no effect but for the N pole, there were two to three times higher magnetic field amplitudes between the plates (5).

However, Zinc and Cupper plates positioning parallel and connected to DC voltage showed that when S pole position toward the positive Zinc and the sensor behind the copper plate, and a negative charge steel plate inserted between the plates its induced amplitude reduction while positive charge steel induced increase magnetic field amplitude.

Interesting, similar trend observed when the voltage disconnected also the amplitude of the positive steel was smaller.



Reference:

1. Sommerfeld, Arnold 01.01.1928.
2. Tunneling, https://chem.libertext.org/@go/page/1722.
3. https://phys.libertext.org/@go/page/4532.
4. N M Ravindra and Jin Zhao Department of Physics, New Jersey InStitute of Technology, Newark, NJ 07102, USA Received 13 April 1992, accepted for publication 29 June 1992.
5. https://phys.libertext.org/@go/page/94131.